

UNPUBLISHED PRELIMINARY DATA

SEMI-ANNUAL REPORT TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Research Under Grant NSG-317-63.

During the period July 1 to December 31, 1964 the following investigations have been carried out:

1. Approximately 150 chondrules from the Bjurböle, Chainpur and Ochansk chondrites, previously analysed for Fe, Mg and Si, have now been analysed for Ni, Al and Ca. These results are being evaluated and prepared for publication. Earlier observations indicating that Al and Ca are present in all chondrules are confirmed by these analyses: consequently, monomineralic chondrules are either scarce or non-existent, because all these elements can not be accommodated in any single meteoritic mineral. Of particular importance to theories on the origin of chondrules is the limited variation found in the Mg/Si ratios. The average iron content seems to be considerably higher than reported recently by other investigators. Some independent checks have therefore been under taken.
2. Current investigations of phosphates in iron meteorites are being extended in cooperation with Dr. Edward Olsen, Chicago Natural History Museum. This work has resulted in the identification of the iron phosphates sarcopside and graffonite, and in the confirmation of farringtonite, earlier reported by other workers as a meteorite mineral. The sarcopside and graffonite found have practically identical chemical composition with only minor amounts of Mn and Ca in contrast to the terrestrial iron phosphates.

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3. Polished thin sections have been prepared of a number of meteorites which have been artificially recrystallized under various temperature- and redox conditions. Redistribution of different elements between coexisting phases is being studied by means of microprobe- and x-ray diffraction techniques.
4. A new series of shock experiments are underway in cooperation with Mr. Paul De Carli at the Stanford Research Institute. The purpose of this investigation is to determine mineralogical changes caused by shock waves in meteorites different from those earlier studied, particularly with regard to water content.
5. The study of the coexisting minerals in the Orgueil carbonaceous chondrites has been extended, and the theoretical interpretation on the basis of mineral equilibria has been completed. The results have been presented and discussed at the Space Research Symposium in Berkeley, in October 1964, and are now being prepared for publication.
6. In preparation for the work, planned by Dr. A. Reid, who has joined our group as of January 1st, the development of suitable techniques has been initiated for analysis of the microscopic structure of aggregate particles in chondrites.
7. The work, in collaboration with Short and Andersen on nickel diffusion gradients in iron meteorites, and their significance, has been completed and prepared for publication (Ref. 3, below).

During this period the following papers have been published or submitted for publication.

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(1) Fredriksson, K., and K. Leil, (1964). The iron, magnesium, calcium and nickel distribution in the Murray carbonaceous chondrite. Meteoritics Vol. 12, No. 3. (NASA Preprint TM X-54, 050)

(2) Fredriksson, K. and C. A. Andersen, (1964). Electron probe analysis of cooper in meneghinite. American Mineralogist 49 (9 & 10): pp. 1467-1469, Sept.-Oct.

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(3) Short, J. and C. Andersen, (1965). Electron probe analysis of nickel diffusion gradients in iron meteorites and the cooling history of the meteorite parent bodies (preprint).

Twenty-five preprints of the latter article and 6 reprints of No. 1 have been submitted as Encls. 1 and 2 of this report. Reprints of No. 2 will be sent as soon as they are available.

 for K.F.
Gustaf Arrhenius and Kurt Fredriksson

Principal Investigators

Enclosures:

- 6 copies of ref. (1)
- 25 copies of ref. (3)